

The Kepler Space Telescope

Kepler Space Telescope

The Planet Hunter

Kepler (Kep-ler) is a space telescope (tel-e-scope). It was named after German **astronomer** (as-tron-o-mer) **Johannes Kepler**, who described the way planets **orbit** (or-bit) stars. Kepler launched in 2009 and began its mission: to look for planets around stars outside our **solar system** (so-lar sys-tem). Such planets are called **exoplanets** (ex-o-plan-ets). So far, Kepler has confirmed 74 exoplanets. But there may be thousands more exoplanets, and these are only in the one area of space Kepler is studying.



How Kepler "Sees" Planets

Planets orbiting distant stars are very hard to see. A star's bright light prevents us from seeing the much smaller, dark planets orbiting around that star. Kepler scientist Natalie Bathala says trying

to see a distant planet is like trying to see a flea walk across a distant car

headlight. But Kepler has a powerful light **sensor** (sen-sor) called a **photometer** (pho-tom-e-ter). The photometer is nine times more sensitive to light than even the best digital cameras. It is pointed at the same patch of sky all the time and "watches"

that patch continuously. Not even Kepler's photometer can "see" a planet next to its star. But it is able to detect the slight dimming of a star's light when a planet **transits** (tran-sits), or crosses, in front of it. Scientists call this slight dimming a **blink**.

Are We Alone?

There are many questions scientists hope Kepler can help answer. Is it common for stars to have planets orbiting them? Are there other planets like **Earth**? Might those planets have life?

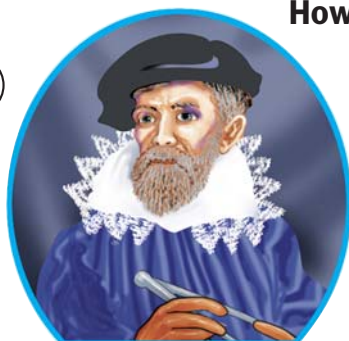
Part of Kepler's mission is to find planets that are similar to Earth. Such planets are most likely to support life. These planets would be about the same size as Earth and would have similar **gravity** (grav-i-ty). Smaller planets might not have enough gravity to hold an **atmosphere** (at-mo-sphere). Much larger planets might have gravity so strong that gases couldn't escape. These planets would be gas giants like Jupiter. A planet's distance from its star is also important. An Earth-like planet must be close enough to its star to have liquid water. It would also have an orbit that is close to Earth's 365 days. A planet that is close to a star but not too close is in the **habitable** (hab-it-a-ble) **zone**. In December 2011, Kepler confirmed the first exoplanet orbiting its star in the habitable zone.

DID YOU KNOW??

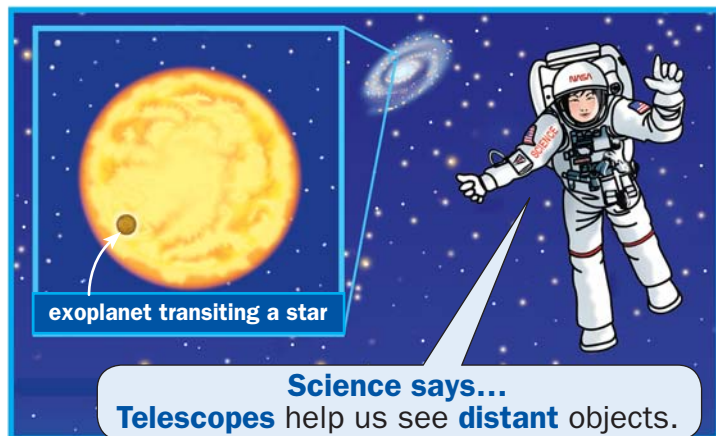
The stars Kepler observes are hundreds to thousands of **light years** away. A single light year is about 6 **trillion** miles.

DID YOU KNOW??

Kepler's **field of view** contains more than 100,000 Sun-like stars.



Johannes Kepler
1571–1630



DID YOU KNOW??

The **habitable zone** around a star is often called the **Goldilocks zone**. It is "just right" for life.



Vocabulary

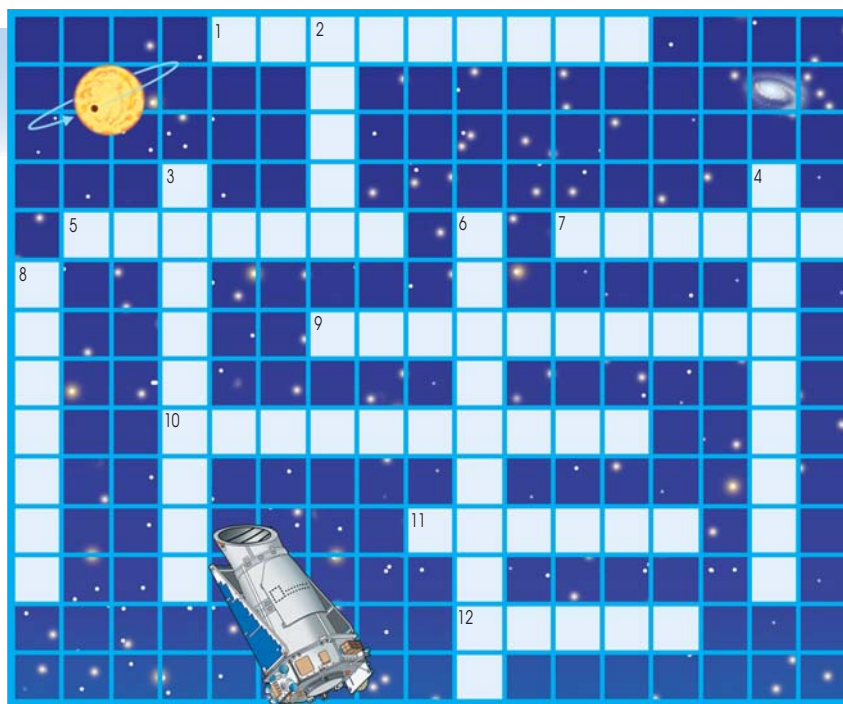
Complete the crossword puzzle.

Across

1. space object around a star outside our solar system
5. force that attracts objects toward Earth
7. German scientist Johannes _____
9. layer of gases at a planet's surface
10. scientist who studies space
11. a device that is able to sense and respond to something
12. this planet is able to support life

Down

2. to circle a star
3. zone that is just right for life



4. instrument to see distant objects
6. Kepler's light sensor is called a _____
8. to cross in front of a star



Weekly Lab

How does the **transit method** work to find planets around distant stars?

ADULT SUPERVISION REQUIRED

ATTENTION TEACHERS: Please read the Teaching Notes before beginning this activity.

You need: a lamp with a frosted incandescent bulb, modeling clay, string, safety goggles

Step 1: Make a planet out of the clay and stick it on the end of a string.

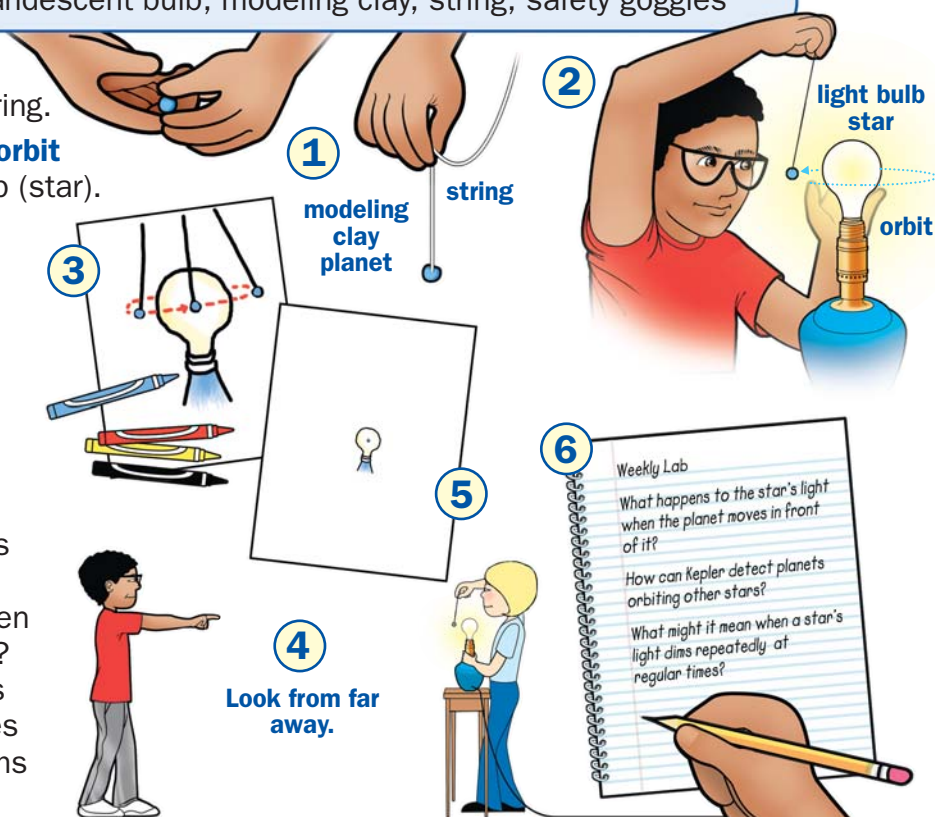
Step 2: Move the planet in a circle or **orbit** (or-bit) around the lit lamp bulb (star).

Step 3: Make a drawing of what the transit looks like.

Step 4: Move as far away from the lab as you can. Is it harder to see the planet in orbit?

Step 5: Make another drawing of what you can see farther away from the lab.

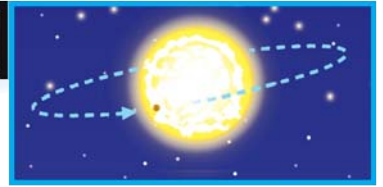
Step 6: Answer the following questions in your science journal: What happens to the star's light when the planet moves in front of it? How can Kepler detect planets orbiting other stars? What does it mean when a star's light dims repeatedly at regular times?



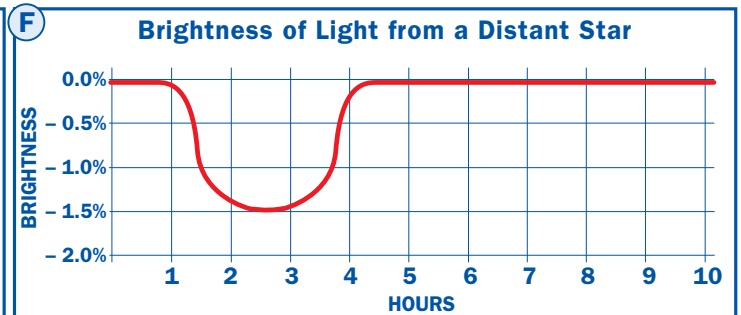
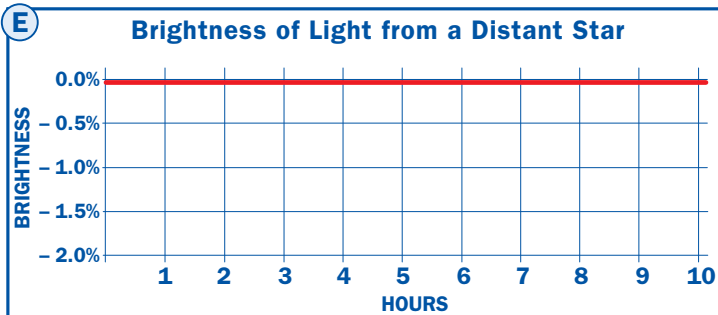
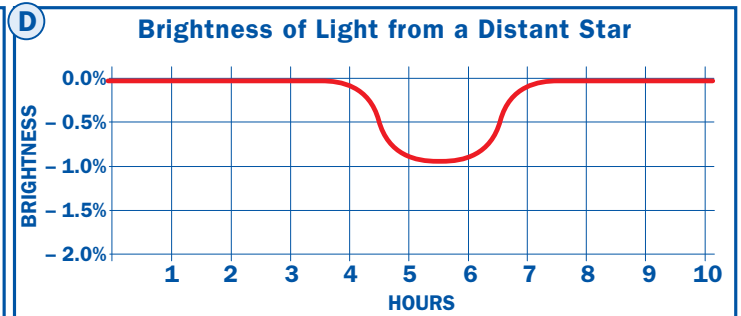
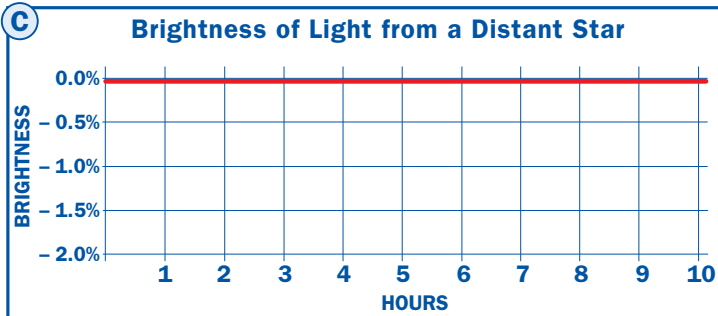
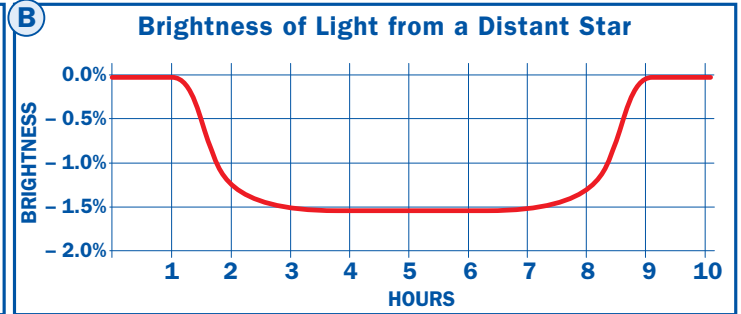
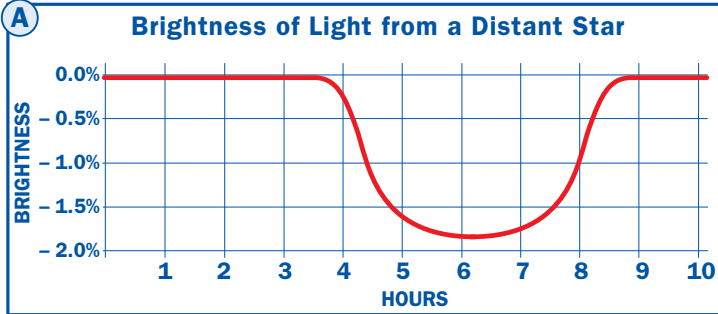


Math

01:20:36



The graphs measure the brightness of light from a distant star. Answer the questions in your science journal.



DID YOU KNOW??

Kepler has a **95-megapixel digital photometer**. A really good photographer's camera might have 10 megapixels.

1. Which graphs might show a planet crossing, or transiting, the star? Explain your answer.
2. Which graphs indicate no planets in orbit? How can you tell?
3. Which graph shows a planet with a longer orbit? How can you tell?
4. What does a longer orbit mean?



Writing in Science

Answer the questions in your science journal.

Writing in Science

1. Why are exoplanets hard to find?

2. How can light brightness graphs help find planets around other stars?

3. What other information can we learn from light brightness graphs?

4. Why do scientists look for other planets?

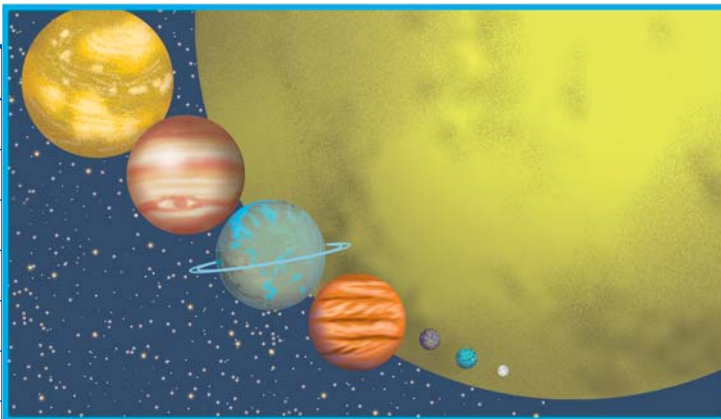




Challenge

Study the table and use it to answer the questions. Write the answers in your science journal.

Planet Name	Size Compared to Earth	Days to Orbit Star
Earth	same	365
Jupiter	11 times larger	4,330
Kepler-9b	9 times larger	19
Kepler-11b	2 times larger	10
Kepler-18b	7 times larger	3.5
Kepler-22c	2 times larger	290
Kepler-30c	14 times larger	60
Kepler-34b	70 times larger	288



- Which planets in the table are likely to be gas giants like Jupiter?
- Planets with short orbits are closest to their stars. Planets with longer orbits are farther away. Which planet is closest to its star? Which farthest away?
- Kepler-11b is not much bigger than Earth. Do you think it is in the habitable zone?
- Which planets have orbits similar to Earth's? Might they be in the habitable zone?
- Which planet in the habitable zone is most similar to Earth? How much does it differ? If there were life on this planet, how do you think it might be different from life on Earth?



Bringing It Home

Do some research to find out about various parts that make up the Kepler telescope and what each part does. Use materials suggested here or others to make a model of the Kepler telescope. Draw a diagram of your finished model and label the parts. Explain the parts and what each part does, to a partner.

Adult Participation Recommended

You need: various materials such as cardboard tubes, cardboard, paper, plastic jar lids, beads, paper clips, etc.; scissors; glue; markers

Kepler telescope

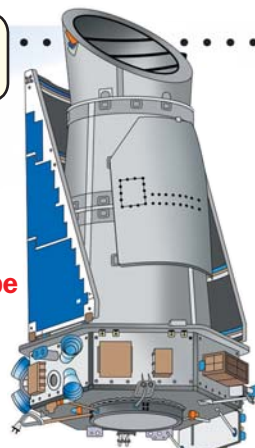


diagram of Kepler model in science journal

